

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2022-103

Anonymous Referee #1

Referee comment on "A tool for air pollution scenarios (TAPS v1.0) to enable global, long-term, and flexible study of climate and air quality policies" by William Atkinson et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-103-RC1>, 2022

General comments

The study describes a modelling framework to estimate future air pollutant emission pathways for alternative scenarios that combine different climate change mitigation strategies with air pollution controls. The incorporation of air quality and the potential co-effects to global scenario analysis is at the heart of scientific and policy analysis, and the presented TAPS framework will be a relevant contribution to the area. Particularly, the decomposition of future emissions into activity variations and emission intensity changes is helpful to understand future emission trends and support policymakers in policy design.

I have some general comments. First, I believe that the contribution of the study could be re-articulated. The generation of alternative scenarios of air pollutant precursor emissions has already been addressed by different models in the context of global scenario analysis. I think the main innovation of the presented TAPS framework is the flexibility to allow the user to combine alternative climate objectives with air pollution control policies, using the most updated emission factors from GAINS. This should be more clearly stated in order to better frame the study. Also, I include some specific comments (below) aimed at clarifying the contribution of the work.

My second general comment is associated with the design of the air pollution control scenarios (Table 3). While the authors fit an exponential function to extend the EF assumptions from GAINS (2050) to the end of the century, it is not clear enough what is the rationale behind extending the MFR approach. According to the definition, MFR represent the "maximum technically feasible reduction" based on today's knowledge of technological capacity. Therefore, having an additional decreasing emission intensity for the second part of the century is very uncertain and should be justified. Considering this uncertainty, adding an analogous "*MFR forever*" scenario could be useful.

Overall, the study is a relevant contribution for a large research community focused on global scenario analysis, and I would recommend it for publication after moderate revisions.

Specific comments

L30: I would suggest adding some evidence from any epidemiological study, such as the latest GBD study (Murray et al 2020).

L35: Beyond its damages to crops, O₃ has also a significant impacts on human health (e.g., Turner et al, 2016), particularly relevant for future scenario simulation (due to the large uncertainty on its precursors). It could be mentioned there.

L85: Apart from full CTMs, the outcomes from TAPS could also be combined with air quality emulators to explore the concentration levels and health inputs of alternative scenarios, as it has been done in some of the studies mentioned in the introduction (e.g., Markandya et al, 2018; Vandyck et al, 2020; Reis et al 2022).

L130: Apart from the study, citing the CEDS release may be helpful to identify the version: (perhaps <https://doi.org/10.5281/zenodo.3865670>)

L198: It would be useful to clarify why it is assumed that the MFR EFs tend to zero in those sectors where no activity (only emissions) is represented (e.g., waste).

L275: In Figure 2, adding scenario-specific lines within ranges (at least for TAPS) would be interesting to see the differences across the air pollution control strategies.

L319: It is strange that figures are shown up to 2050, but the results on this section 3.2. are discussed for the whole century. This should be consistent, either by adding 2100 figures (in addition of the results for 2050) or by discussing the effects until mid-century.

L320: Why is coal not phased-out with the implementation of the NDCs? This may be a result from the EPPA model but could be additionally elaborated because it seems to be counterintuitive (also in L327).

L389: I do not think that a "constant EFs" scenario would be useful, considering that there

is “current legislation” (CLE).

L426: Beyond health impacts, the outcomes from TAPS combined with other tools (as for health) could be applied to explore other air-pollution-related damages on crops, biodiversity, forestry, or labor productivity.